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THE WESTERN FLOWER THRIPS AND THE SWEETPOTATO WHITEFLY: NEW PESTS THREATENING FLORIDA TOMATO PRODUCTION

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Tomato production in Florida, like any other agricultural production system, is dynamic, constantly changing and adapting to new situations and problems. Management of pests within the production system should also be dynamic, requiring adaptation to new pest situations.

Two insect pests currently threaten to require changes in pest management in Florida tomato production, the western flower thrips (*Frankliniella occidentalis* (Pergande)) and the sweetpotato whitefly (*Bemisia tabaci* (Gennadius)). Both of these pests are a threat, not only because of their direct attack on plants and their resistance to insecticides, but also because of their potential to transmit virus diseases.

WESTERN FLOWER THRIPS

The western flower thrips was first described from specimens collected from California in the late 1800's and was restricted to the western half of the country. In recent years the thrips has moved to the southeastern U.S., being first recorded in Georgia in 1981 (Beshear 1983) and Florida in 1982 (Denmark, personal communication). It has since been collected from the panhandle to Miami. The western flower thrips was first collected from tomato in the Quincy area in 1985 but has not been collected on tomato in other production areas (Denmark, personal communication). Populations at Quincy are currently low (Tappan, personal communication).

Western flower thrips adults are minute, elongated (0.5 mm) insects. Their wings have a feathery fringe and their bodies are generally light yellow. Eggs are inserted into the more tender plant tissues such as stems, buds and flower parts (Bailey 1938). The immature stages, called nymphs, begin feeding immediately upon hatching from the eggs. When they are full grown, they drop to the soil where they form non-feeding, resting stages (pre-pupae and pupae). Adults emerge to complete the life cycle. At 85 F, the egg to adult developmental time is about 2 weeks (Lubinkof & Foster 1977).

The western flower thrips has a host range of at least 140 plant species including numerous weeds and cultivated hosts (Bryan & Smith 1956). Using their rasping-sucking mouthparts,

they scrape the tissue surface and suck the juices that exude. The thrips occurs primarily in the flowers where they feed on nectar, pollen grains, anthers, ovaries or small fruit. While some believe that flower thrips improve pollination, populations of about 10 per flower of a thrips (*F. bispinosa* (Morgan)) closely related to western flower thrips have resulted in increased bloom drop on tomato (Schuster, unpublished data). On grapes, feeding on developing berries results in scarring. Oviposition on young grapes results in scars surrounded by a light halo (Yokoyama 1977). This damage is similar to what was observed on tomatoes in the Quincy area in 1985.

In addition to direct damage, the western flower thrips is an efficient vector of tomato spotted wilt virus. The virus has been documented from Jackson, Santa Rosa, Okaloosa, Jefferson, Walton, Washington and Alachua counties on crops including gladiolus, peanut, tomato, tobacco and watermelon (Simone 1987, Sprenkel 1986). The disease has been recorded from at least 200 plant species around the world and has been shown to be dessiminated by eight other thrips species besides western flower thrips (McRitchie 1986). At least two of these, the tobacco thrips (*F. fusca* (Hinds)) and the onion thrips (*Thrips tabaci* Lindeman) also occur in Florida. Although the tomato spotted wilt virus occurs in the Quincy tomato production area, it has not yet been observed in other production areas. The thrips which predominate in central and southern Florida are *F. bispinosa* and *F. cephalica* (Crawford). It is not known whether these closely related species can transmit the virus. The symptoms of the virus vary considerably depending upon the host plant. The foliage of infected tomato plants have thickened veins, downward curled leaves and ring spots. Green fruit have light green rings with raised centers and appear lumpy. Infected plants are stunted.

Resistance of the western flower thrips to insecticides applied for their control has often been suggested but has not been well documented. Recent insecticide trials on a variety of crops indicate that there are a number of insecticides registered for use on tomato that are effective for controlling the thrips. These include Thiodan on tomato (Oetting 1986), Monitor on cotton (Graves et al. 1987) and Vydate, Lannate and Cygon on the ornamental torenia (Neal et al. 1984). On lettuce, Lannate, Guthion and Phosdrin were effective in reducing thrips numbers but were ineffective in reducing the incidence of tomato spotted wilt virus (Cho et al. 1986). This emphasizes the importance of integrating insecticides with other measures for managing the thrips-virus complex.

Western flower thrips-infested tomato plants in the Quincy area in 1985 were associated with wheat plantings. Adults apparently migrated to the tomatoes in large numbers as the wheat ceased flowering, indicating the importance of not planting tomatoes near or adjacent to alternative thrips hosts. Thorough management of weeds both within and adjacent to tomato fields should be practiced. Common beggar tick (spanish needle) is a common weed in central and south Florida and is an excellent host of the thrips. Reflective mulch (black plastic painted with

aluminum paint) resulted in reduced thrips numbers and tomato spotted wilt virus incidence (Greenough 1985). Reflective mulches have also been effective in delaying the appearance of aphid-borne virus diseases as well (George & Kring 1971).

SWEETPOTATO WHITEFLY

The sweetpotato whitefly has been noted in Florida since the late 1800's but has only been considered a pest in the state during the past year (Price 1987). The insect is distributed throughout the tropical world and attacks at least 500 species of plants including numerous weeds and cultivated vegetable, agronomic and ornamental crops (Greathead 1986). Vegetables most often attacked include those in the families Solanaceae (including tomato, eggplant & pepper) and Cucurbitaceae (including cucumber, melons & squash). The adults are small insects about 1 mm long with pale yellow bodies and white wings. They resemble small flies but are actually more closely related to aphids since they have piercing-sucking mouthparts. Adults prefer the younger leaves and deposit minute, cigar-shaped eggs on the lower surfaces of these leaves. The eggs are attached to the leaves with short stalks. The immature stages are usually called nymphs and also have piercing-sucking mouthparts. The newly hatched nymphs have well-developed legs and are the only mobile nymphs. After finding a suitable feeding site on the lower leaf surface, these 'crawlers' attach to feed and usually do not move again. The subsequent three nymphal stages appear as flattened, oval scales and are not mobile. The final immature stage (resting or pupal stage) is more convex and elliptical and has large, conspicuous red eyes (Lopez-Avila 1986). The developmental time from egg to adult at 80 F on tomato is about 4 weeks (Coudriet et al. 1985). Because of the delay between the time of egg deposition and tha completion of development, the immature stages, particularly the pupal stage, may be found on lower, older leaves, especially on rapidly growing plants (Ohnesorge et al 1980).

Nymphal and adult whiteflies damage plants by sucking their sap. Chlorotic spots may appear on the upper leaf surfaces and affected plants may become unthrifty. All whitefly stages beyond the egg stage also produce honeydew upon which sooty mold can grow. In addition, the sweetpotato whitefly is a known vector of about 19 virus diseases (Brunt 1986). In 1981, an estimated $8 million in damage occurred on cantaloupe, melons and squash in California (Duffus & Flock 1982). Estimates of yield losses of lettuce ranged from 50 to 75 percent. Sweetpotato whitefly-transmitted viruses affecting tomato include tomato yellow leaf curl in the middle east and tomato yellow mosaic and tomato golden mosaic in tropical America (Brunt 1986).

Fortunately, no viruses in Florida are known to be transmitted by whiteflies; however, the possiblity exists that viruses presently attacking weeds could be disseminated to crop plants or that other whitefly-vectored viruses could be imported into Florida. The whitefly has been a serious pest in the vegetable producing desert valleys of California when populations

have migrated from cotton, other crops and weeds (IPM Manual Group 1985); however, no whitefly-vectored virus has been reported on tomato there.

During the past year, the sweetpotato whitefly has been a serious pest of ornamental greenhouse and saranhouse crops, particularly poinsettia. A heavy field infestation was discovered this spring on eggplant in the Boynton Beach area. The eggplant had been double-cropped with cucumber, although the cucumber crop had senesced by the time the whitefly infestation was first reported. Later, a crop of chinese melon on an adjacent farm was found to be heavily infested. Thus, both of these infestations on field-grown vegetables may have been associated with cucurbit crops. Active but less severe infestations of the whitefly were found on every other vegetable farm inspected in the vicinity including those growing tomato, pepper, cucumber and snap beans.

Insecticides have most often been used to manage the sweetpotato whitefly, especially on cotton. Resistance to organophosphate and synthetic pyrethroid insecticides has been reported in California (Prabhaker et al. 1985). The effectiveness of selected insecticides is being evaluated at Bradenton on poinsettia both in the laboratory using lab-reared sweetpotato whiteflies and in the greenhouse using a naturally occurring population. Results to date indicate that, of insecticides currently registered for use on tomatoes, Thiodan, Lindane, Ambush (either alone or combined with Butacide) and Pyrenone provide very good kill of whitefly adults in the laboratory. These same insecticides plus Monitor, Cygon and Asana also indicated adult control in the greenhouse. Ambush, Asana, Pyrenone and Vydate resulted in the most consistent reductions in the numbers of nymphs surviving to adult emergence in the greenhouse. Thus, registered insecticides are available for the management of this pest on tomato. Reports from greenhouse growers indicate that the effectiveness of any given insecticide may vary from one whitefly population to another. Growers who encounter this pest on tomato should alternate insecticides of different chemical classes to reduce the potential for the development of resistance. Thiodan and Lindane are chlorinated hydrocarbons, Pyrenone is pyrethrum, Ambush and Asana are pyrethroids, Monitor and Cygon are phosphates, and Vydate is a carbamate. Thorough coverage of foliage, particularly the lower, older leaves, is essential to control nymphs and pupae.

Biological control of the sweetpotato whitefly has been studied in many parts of the world. About 25 species of parasites and 15 species of predators have been recorded attacking the whitefly (Lopez-Avila 1986). Increases in whitefly populations have been observed following the applications of non-selective insecticides (Matthews 1986). It has been suggested that this might occur because of the reduction in numbers of small, wasp-like parasites which attack the immature stages. We have recently recovered a parasite attacking sweetpotato whitefly immatures on tomato plants in a greenhouse. At least half of the immatures were parasitized. Although the

parasite has been observed on the whitefly on weeds in the immediate vicinity of the greenhouse, it is not known whether this parasite can survive or be effective outside a greenhouse. There is little information available regarding the impact of specific insecticides on parasites of the whitefly. Thus, broad-spectrum insecticides should be used as sparingly as possible to avoid causing whitefly populations to increase.

Cultural manipulations may aid in the management of the sweetpotato whitefly on tomato. Since the insect can survive on a wide range of weed species, weeds should be thoroughly managed both in and around fields. Tomatoes should not be planted adjacent to or following cucurbits since these crops may result in greater numbers of whiteflies migrating to the tomatoes. As with the western flower thrips, reflective mulches may reduce the numbers of invading adult sweetpotato whiteflies that alight on tomato plants.

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